

## **REMARKS/ARGUMENTS**

### **A. Concerning the Amendments**

Claims 25 and 26, drawn to claim elements comprising a method of making the claimed alcohol composition, are amended herein to specify an additional preparation step. The incorporated step is a first step (a) comprising "hydrolyzing a seed oil with water or transesterifying a seed oil with a C<sub>1-8</sub> alkanol, respectively." Support for the amendment is found at page 10, lines 18-32, continuing onto page 11, lines 1-15, of the specification.

Claim 34 is amended to correct an inadvertent error in pressure units for the hydrogenation step. "Psia" is amended to "psig" as found at page 17, lines 16-18, of the specification.

Claim 35 is amended to delete the term "C<sub>1-15</sub> alkanol" and substitute therefor the term "C<sub>1-4</sub> alkanol." Support for the amendment is found at page 10, lines 28-30, of the specification.

### **B. Concerning an Inadvertent Error in the Amendment Filed April 30, 2008**

The Office Action of July 23, 2008 observes an inadvertent error in the Amendment entitled "Response C" filed by Applicants on April 30, 2008. Page 1 of said Amendment correctly states the application serial number as "10/551,854;" however, the subsequent headings on pages 2 through 12 of said Amendment inadvertently states the application serial number as "01/551,854." The record is amended herein by deleting the incorrect serial number in the header at pages 2 through 12 of Response C and substituting therefor the correct serial number "10/551,854." For clarity of record, a corrected copy of Response C is enclosed herewith.

### **C. Concerning the Telephonic Interview of November 12, 2008**

On November 12, 2008, the undersigned and inventor Dr. David A. Babb held a telephonic interview with Examiner Yate Kai Rene Cutliff and her Supervisory Examiner (Ms. Rosalynd Keys). The undersigned presented arguments concerning (1) the scope of the prior art, (2) the scope of the claims, Claim 1 in particular, (3) differences between the prior art and the claims, and (d) arguments for patentability as are repeated hereinafter. Arguments were presented as to why Declaration I and II offer valid comparative data. The Examiners requested that the arguments concerning the Declarations be filed in a third declaration. While no agreement was reached on the claims, Applicants found the Telephonic Interview helpful in preparing the present response; and in this regard, the Applicants extend their gratitude to both Examiners.

Applicants are in agreement with the Interview Summary, dated November 24, 2008, mailed from the Patent Office.

### **D. Concerning the Rejection Under 35 USC 103(a)**

The Office Action find Claims 18 to 35 as obvious for the reasons of record, based on new ground(s) of rejection in view of Frankel (US 3,787,459), Bahrmann et al. (CA 2,162,083), and Khoe, et al. (*Journal of the American Oil Chemists' Society*, 49, 1972). This action is traversed for the following reasons.

(1) Prior art: Frankel, Bahrmann et al. and Khoe et al..

Frankel discloses hydroformylation of a seed oil (unsaturated fatty acid ester(s)) to form a mixture of formyl-substituted fatty acid esters, primarily mono- and di-formylated mixtures, and hydrogenation of the formylated product to the corresponding hydroxymethylated product. Significantly, Frankel misses three key elements of the claims. (1) No teaching is given whatsoever to a quantity of tri-formylated product, let alone a quantity of trihydroxymethylated product, further in the claimed range from greater than about 0.1 to less than about 10 weight percent. (2) No teaching, suggestion, or hint is given to the claimed diol/triol weight ratio greater than 5/1. Assuming that the diol/triol ratio is implicit (*which it is not because the quantity of triols is not mentioned and the emphasis is on formyl-substituted products*), then it would also be the case that other ratios are implicit, for example, the weight ratio of saturates/unsaturates, the ratio of mono-ols/diols, and the ratio of mono-ols/triols. Nothing in Frankel points to an effect of a diol/triol ratio on properties of downstream polyurethane foams.

Bahrmann et al. discloses hydroformylation of linseed oil methyl esters to form a mixture of formyl-substituted fatty acid esters and further discloses hydrogenation conditions for converting the formyl-substituted product to the corresponding hydroxymethylated product. Tables 1 and 2 of Bahrmann et al. disclose compositions of mono-formyl, diformyl, and triformyl fatty acid esters; but Bahrmann et al. fails to mention or suggest a diformyl/triformyl ratio, let alone a diol/triol weight ratio. Calculations using the examples of Bahrmann et al. yield implicit diformyl/triformyl ratios less than 5/1, outside the claimed range. Moreover, other ratios are implicit in Bahrmann et al. including a ratio of saturates/unsaturates, a ratio of mono-ol/diol, a ratio of mono-ol/triol, among others. No significance is placed on any ratio.

Khoe et al. is cited for teaching hydroformylation of seed oils to formyl-substituted products, hydrogenation of the formyl-substituted products to the corresponding hydroxymethylated product mixture, and use of the latter composition in preparing rigid polyurethane foams. Khoe et al. at Table 1 illustrates various hydroxymethylated compositions, all of which contain tri-substituted esters ranging in quantity from 18.1 to 42.8 weight percent, which is well in excess of the upper limit of 10 percent triols required of Claim 1. Moreover, Khoe et al. does not explicitly teach a diol/trio ratio. Implicit in Khoe et al. are diol/triol ratios in the range from 0.58 (Example 1) to 1.99 (Example 4), which lie outside the scope of the claims. Moreover, the skilled person would find implicit in Khoe et al. other ratios including the ratio of saturates/unsaturates, the ratio of mono-ols/diols, and the ratio of mono-ols/triols among others.

Nothing in Frankel, Bahrmann et al. and Khoe et al. points the ordinary person skilled in the art in the direction of a diol/triol ratio specifically, or would render the diol/triol ratio as beneficially advantaged over any other ratio inherent in the references. Nothing in any reference links the diol/triol ratio specifically to effects on properties of downstream polyurethane foams, specifically, flexible foams – *a mental connection necessary to the conception of the claimed invention*. The skilled person is merely offered teachings drawn to compositions outside the scope of the claims and teachings of many inherent ratios of no particular significance. In summary, Frankel is silent regarding important aspects of the claims, while Bahrmann et al. and Khoe et al. disclose a scope broader than the claimed scope. No reference recognizes the results effective parameter claimed (diol/trio ratio >5/1).

The Office Action states on page 7: "... However, Khoe et al. teaches that it is known in the art to change parameters of diol to triol changes the parameters of the foam. .... Table II shows that the parameters of the foams change when the diol to triol ratios are changed." This statement reads more significance into Khoe et al. than the reference presents. The statement presumes that the diol/trio ratio is explicitly taught, ear-marked as advantaged, and linked to the properties of the resulting rigid foams. Khoe et al. does none of this. The diol/triol ratio is neither calculated nor earmarked; no ratio, let alone the diol/triol ratio is calculated or linked to downstream foam properties. Rather, Khoe et al. relates to implicit diol/triol ratios less than the critical ratio of 5/1; thus teaching away on a critical aspect of the claimed invention.

Applicant acknowledges that the inherent diol/triol ratios of Khoe et al. are somewhat different in samples 3 (di/tri = 1.19), 4 (di/tri = 1.99) and 5 (di/tri = 1.23). Each sample, however, is substantially different in chemical composition based on the esters used. Samples 3, 4, and 5 are hydroxymethyl linseed monoesters of glycerol, trimethylolpropane, and pentaerythritol, respectively (Table 1, footnote b). The monoester of glycerol comprises 2 hydroxyls (2 primary or 1 primary & 1 secondary). The monoester of trimethylolpropane comprises 2 primary hydroxyls. The monoester of pentaerythritol comprises 3 primary hydroxyls. It is reasonable to expect that differences in the type (primary vs. secondary) and number (2 vs. 3) of ester-introduced hydroxyls cause changes in the foams. Significantly, Khoe et al. lacks any controlled experiments correlating foam properties to explicit differences in type and number of hydroxyl functionality introduced from the ester (alcohol), let alone any other different (*and implicit*) ratio like the diol/triol ratio related to hydroxymethyl functionality introduced via seed oil hydroformylation/hydrogenation.

More to the point, the claimed composition is used for making flexible foams, while Khoe et al. teaches in the opposite direction towards rigid foams. Based on the cited references, alone or in combination, the skilled person at the time of the invention could not have predicted how foam parameters would have changed by changing any parameter or ratio, let alone the diol/triol ratio. There would have been no reasonable expectation of success to produce a composition suitable for flexible foam applications by randomly changing the diol/triol ratio.

Finally, Applicants have amended their claims to ensure that the process of making their claimed composition includes hydrolysis or transesterification of the seed oil to obtain one or more unsaturated fatty acids or unsaturated fatty acid esters, prior to hydroformylation (hydroxymethylation). This critical element further differentiates the invention from Khoe et al, where linseed oil triglyceride ester or a linseed oil polyol (monoglyceride, pentaerythritol, methylolein) is hydroformylated (hydroxymethylated) directly. This distinction would argue against any direct comparison of the claimed composition with Khoe's compositions.

MPEP 2143.01 (III) states: "The mere fact that references can be combined or modified does not render the resultant combination obvious unless "the results would have been predictable to one of ordinary skill in the art." It is submitted that the Office Action has not established *prima facie* obviousness of the Applicants' invention with the combination of Frankel, Bahrmann et al., and Khoe et al.

## (2) Declarations I and II

The Office Action alleges that the Applicants have provided "non-comparative" data, pointing to the first Declaration which uses soy oil esters for examples of the invention (di/tri = 14.07/1) and linseed oil esters for illustrations of the prior art (di/tri =

3.4/1), and Declaration II which uses sunflower oil esters for another example of the invention (di/tri = 5.4/1). Moreover, the formulation of Declaration II uses a different quantity of water, different Voranol, and different catalyst as compared with the formulations of Declaration I.

In reply, Applicants and the undersigned assert that a good faith effort was made to present fair and valid comparative data. Many hours were spent discussing the experimental design for Declaration I and which data could be additionally supplied for Declaration II. We note that all parameters in Declaration I were precisely controlled, with exception of the seed oil and, of course, the diol/triol ratio to be compared. Applicants assert that variation of the diol/triol ratio over a broad range from 3/1 (within the prior art) to 14/1 (within the scope of the invention) with one individual seed oil is not easily accommodated; consequently different seed oils were used. After submission of Declaration I, the Office requested another example of the invention closer to the diol/triol cutoff of 5/1. The obtention of new examples for a second declaration would have required the resources of several Dow laboratories for a significant time; therefore, Applicants provided in Declaration II data already in-hand. In Declaration IIIA filed concurrently herewith, inventor David A. Babb, who supervised the experiments presented in Declarations I and II, explains how the differences in experimental design between these Declarations would have an inconsequential effect on the outcome of the comparison presented. In Declaration IIIB filed concurrently herewith, inventor Alan K. Schrock concurs with the statements and opinion of David A. Babb as presented in Declaration IIIB.

Pointing to Declaration I, the Office Action observes that the resiliency of the flexible foams derived from the soy-based monomer alcohol of the invention is similar to the resiliency of the flexible foams derived from linseed-based monomer alcohol of the prior art. This observation misses the point. The point is that the comparative foams prepared with the prior art alcohol were defective with tin splits, such that no physical properties other than resiliency could be measured and the foams could not be manufactured commercially. In contrast, the flexible foams made from the claimed composition had overall good properties, no tin splits, and thus were suitable for commercial manufacture. We note that tin splits are elongated crevices and cracks that run throughout the foam, such that the properties of the foam are not uniform and large sections of the foam are not usable.

In view of the above, Applicants maintain that the comparative data presented in Declarations I and II are fair and proper.

(c) Secondary Evidence of Non-Obviousness: Commercial Success/Market Needs

Applicants note that the technology of Bahrmann et al. (1995) is already 13 years old, while the technologies of Frankel (1974) and Khoe et al. (1972) are over 30 years old. To the best of Applicants' knowledge, the technologies of these references lay fallow for decades with essentially no market interest and development. Presently, the time is ripe to replace at least a portion of the world's petroleum-based chemicals with renewable and sustainable seed oil-based chemicals. The Dow Chemical Company, employer of the present Applicants, took the initiative and invested substantially in R&D on seed oil-based chemistry for utilization in industrial chemicals. As a result, Dow introduced into the U.S. marketplace, on September 25, 2007, RENUVA™ Renewable Resource Technology, for producing seed oil-based polyols, based on the present invention, for use in preparing high performance polyurethane products that compare well with polyurethanes made from petroleum-based polyols. Commercial interest and filling a long-felt need in the marketplace provide secondary indicia of non-obviousness.

In view of all of the above, it is submitted that the claims meet the requirements for non-obviousness. It is respectfully requested that the rejection under 35 U.S.C. 103(a) be withdrawn.

**E. Conclusions**

Applicants have submitted claim amendments, arguments, and two Declarations under 37 CFR 1.132 as a rebuttal to the latest Office Action. It is submitted that the amended claims meet all requirements for patentability. A Notice of Allowance is solicited at the Examiner's earliest convenience.

Respectfully submitted,

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Encl.

Request for Extension of Time Under 37 CFR 1.136(a)  
Declaration IIIA Under 37 CFR 1.132 (David A. Babb)  
Declaration IIIB Under 37 CFR 1.132 (Alan K. Schrock)  
Corrected Copy of Response C Filed April 30, 2008

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